Jet modifications using 2+1 $h^{\pm}$-$h^{\pm}$ correlations in Au+Au at $\sqrt{s_{NN}} = 200$ GeV at RHIC-PHENIX

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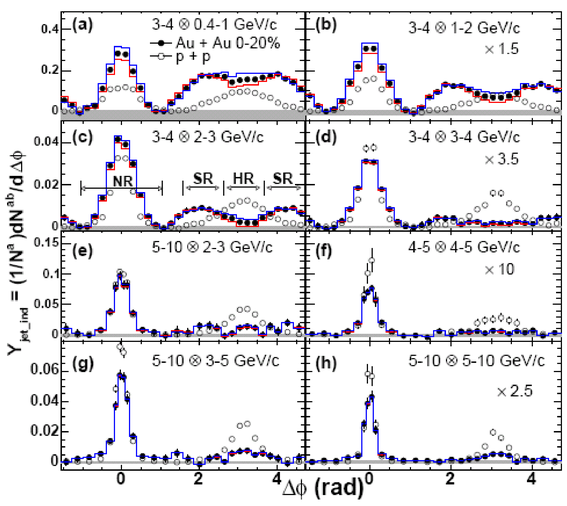
Introduction

The Relativistic Heavy Ion Collider (RHIC) has provided evidence that suggests the existence of a strongly interacting medium. Since partons interact strongly with the medium and lose energy as they traverse it, they serve as a useful probe for measuring the properties of the medium. As a result, measurement from jets have provided insight to how the partons distributions are being modified as they travel through the medium. Because the PHENIX detector does not have full acceptance in azimuth (ϕ) and the multiplicity of heavy ion collisions is so high, full jet reconstruction had been elusive until recently (1). Therefore, two-particle correlations provided an alternative to measuring jets since the distribution of particles are strongly correlated in azimuth (ϕ) and pseudorapidity (η). Previous measurements at RHIC have showed a strong modification in jet induced correlations in azimuth ($\Delta\phi$) (3).

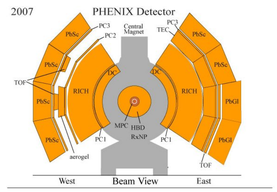


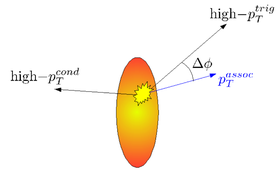
However, since the method usually requires a high-p_T particle to be correlated to lower p_T particles, this biases the measured correlation to be one that has had minimal energy loss in the direction of the high-p_T particle (2). In this analysis, we try to minimize this bias by requiring that there be two high-p_T particles in opposite hemispheres of each other in azimuth (ϕ).

In this analysis, two-particle correlations are done with the requirement that there be a second trigger in the opposite hemisphere relative to the first in azimuth. The jet induced correlation is extracted using the ZYAM method for different p_T and centrality classes and the widths and yields are extracted from each jet induced correlation.

2+1 hadron correlations

The 2007 RHIC run Au+Au data was used for this analysis. For each event, the presence of two high-p_T hadrons that are separated by a minimum angle of $\pi/2$ in azimuth is required. For the events that satisfy such requirement, the remaining hadrons in the event are correlated with respect to the trigger in azimuth ($\Delta\phi$) for different p_T bins.

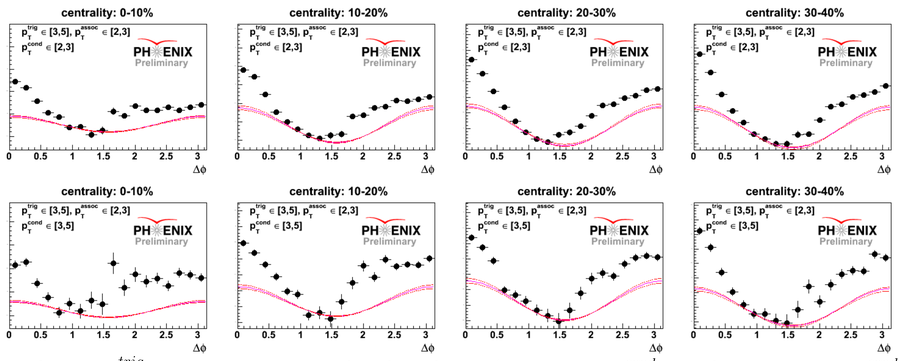




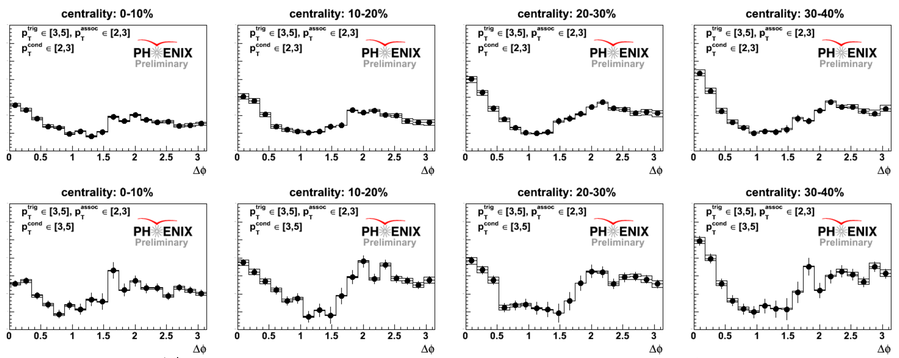
In order to remove any detector and limited acceptance effects from the signal, each signal event trigger is correlated with hadrons from random events to form a mixed-event distribution ($N^{mix}(\Delta\phi)$). The signal-event distribution is then divided by the mixed-event distribution. To extract the jet induced signal $J(\Delta\phi)$ from the acceptance corrected correlation $C(\Delta\phi)$, the two-source model is assumed where the contributions are the jet induced correlation $J(\Delta\phi)$ and the harmonic modulated background.

$$C(\Delta\phi) = \frac{dN/d\Delta\phi}{N^{mix}(\Delta\phi)} \qquad C(\Delta\phi) = J(\Delta\phi) + b_0(1 + 2v_2^t v_2^a \cos(2\Delta\phi)) \tag{1}$$

The v_2 values were determined in previous measurements (4). To determine b_0 the Zero Yield at Minimum (ZYAM) method is used.



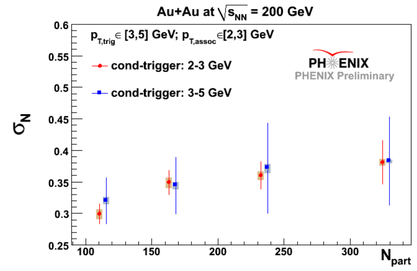
Correlations for $3.0 \le p_T^{trig} \le 5.0$, $2.0 \le p_T \le 3.0$, and conditional trigger(top row: $2.0 \le p_T^{cond} \le 3.0$, bottom row: $3.0 \le p_T^{cond} \le 5.0$)



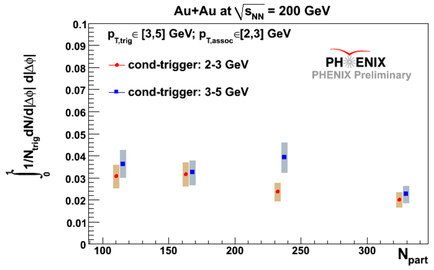
Jet induced correlations for $3.0 \le p_T^{trig} \le 5.0$, $2.0 \le p_T \le 3.0$, and conditional trigger(top row: $2.0 \le p_T^{cond} \le 3.0$, bottom row: $3.0 \le p_T^{cond} \le 5.0$)

Near-side jet measurements

In this analysis the near-side jet width and yield is measured. The width is measured by fitting a Gaussian function to the jet induced correlation and the yield is determined by numerically integrating in the region $|\Delta\phi| < 1.0$



Jet induced correlation near-side width



Jet induced correlation near-side yield

Conclusion and Outlook

In this analysis, the conditional trigger p_T was varied while keeping the p_T of the trigger and associated particle fixed. In the range that it was varied there was no statistically significant difference observed in the near-side yield and widths. However, the jet induced correlations suggest that there is still strong away-side modification and also seems to show the possibility of a punch-through jet emerging from the away-side as the conditional hadron p_T is increased.

References

[1]Y. S. Lai and B. A. Cole, arXiv:0806.1499 [nucl-ex].
[2]T. Renk and K. Eskola, Phys. Rev. C **75**, 054910 (2007) [arXiv:hep-ph/0610059].
[3]A. Adare *et al.* [PHENIX Collaboration], Phys. Rev. C **78**, 014901 (2008) [arXiv:0801.4545 [nucl-ex]].
[4]A. Adare *et al.* [PHENIX Collaboration], Phys. Rev. Lett. **98** (2007) 162301 [arXiv:nucl-ex/0608033].

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